



DV200-2800S Series

HIGH RELIABILITY DC-DC CONVERTERS

DESCRIPTION

The DV200 series of high reliability, isolated DC-DC converters is operable over a wide (-55 °C to +100 °C) temperature range with no power derating. Unique to the DV200 series is a magnetic feedback circuit that is radiation immune. Operating at a nominal fixed frequency of 500 kHz, these regulated, isolated units utilize well-controlled undervoltage lockout circuitry to eliminate slow start-up problems. The current sharing function allows a maximum of five units to be connected in parallel to boost the total output power to 5 times. The output voltage is trimmable up to +10% or down -20%.

These converters are designed and manufactured in a facility qualified to ISO9001 and certified to MIL-PRF-38534 and MIL-STD-883.

This product may incorporate one or more of the following U.S. patents:

5,784,266
 5,790,389
 5,963,438
 5,999,433
 6,005,780
 6,084,792
 6,118,673

FEATURES

- High Reliability
- Parallel Up to 5 Units With Current Sharing
- Output Voltage Trim Up +10% or Down -20%
- Wide Input Voltage Range: 16 to 50 Volts
- Up to 200 Watts Output Power
- Radiation Immune Magnetic Feedback Circuit
- NO Use of Optoisolators
- Undervoltage Lockout
- Short Circuit Protection
- Current Limit Protection
- Input Transient Voltage: 55 Volts for 1 second
- High Power Density: $\approx 80 \text{ W/in}^3$
- Custom Versions Available
- Additional Environmental Screening Available
- Meets MIL-STD-461C and MIL-STD-461D EMC Requirements When Used With a DVMN28 EMI Filter

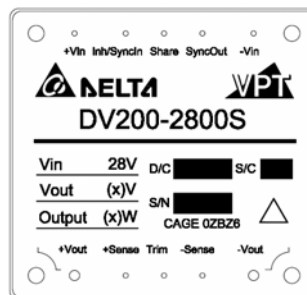


Figure 1 – DV200-2800S DC-DC Converter
(Not To Scale)

SPECIFICATIONS ($T_{CASE} = -55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$, $V_{IN} = +28\text{V} \pm 5\%$, Full Load, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

| | | | |
|---|--------------------|--------------------------------------|-----------------|
| Input Voltage (Continuous) | 50 V _{DC} | Junction Temperature Rise to Case | +25°C |
| Input Voltage (Transient, 1 second) ⁴ | 55 Volts | Storage Temperature | -65°C to +135°C |
| Output Power ^{1,3} | 200 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE} = +100^{\circ}\text{C}$) | 44 Watts | Weight (Maximum) | 115 Grams |

| Parameter | Conditions | DV200-283R3S | | | DV200-2805S | | | Units |
|---|--|--------------|------|-------|-------------|------|-------|-------------------|
| | | Min | Typ | Max | Min | Typ | Max | |
| STATIC | | | | | | | | |
| INPUT Voltage ⁵ | Continuous | 16 | 28 | 50 | 16 | 28 | 50 | V |
| | Transient, 1 sec ⁴ | - | - | 55 | - | - | 55 | V |
| Current | Inhibited | - | 6 | 10 | - | 6 | 10 | mA |
| | No Load | - | 20 | 50 | - | 20 | 50 | mA |
| Ripple Current | Full Load, 20Hz to 10MHz | - | - | 100 | - | - | 100 | mA _{p-p} |
| Inhibit Pin Input ⁴ | To Disable Output | 0 | - | 1.5 | 0 | - | 1.5 | V |
| Inhibit Pin Open Circuit Voltage ⁴ | | 8 | 9.5 | 11 | 8 | 9.5 | 11 | V |
| UVLO Turn On | | 13.5 | 15 | 15.8 | 13.5 | 15 | 15.8 | V |
| UVLO Turn Off ⁴ | | 10.0 | 12.0 | 14.0 | 10.5 | 12.0 | 14.0 | V |
| OUTPUT Voltage | V_{OUT} $T_{CASE} = 25^{\circ}\text{C}$ | 3.267 | 3.30 | 3.333 | 4.95 | 5.00 | 5.05 | V |
| | V_{OUT} $T_{CASE} = -55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$ | 3.25 | 3.30 | 3.35 | 4.925 | 5.00 | 5.075 | V |
| Power ³ | $V_{IN} = 18\text{V}$ to 50V | 0 | - | 100 | 0 | - | 150 | W |
| | $V_{IN} = 16\text{V}$ to 18V | 0 | - | 60 | 0 | - | 90 | W |
| Current ³ | I_{OUT} $V_{IN} = 18\text{V}$ to 50V | 0 | - | 30 | 0 | - | 30 | A |
| | I_{OUT} $V_{IN} = 16\text{V}$ to 18V | 0 | - | 18 | 0 | - | 18 | A |
| Ripple Voltage | V_{OUT} Full Load, 10kHz to 10MHz | - | 50 | 150 | - | 50 | 150 | mV _{p-p} |
| | V_{OUT} Full Load, 10kHz to 2MHz | - | 10 | 50 | - | 10 | 50 | mV _{p-p} |
| Line Regulation | V_{OUT} $V_{IN} = 18\text{V}$ to 50V | - | 10 | 80 | - | 10 | 80 | mV |
| Load Regulation | V_{OUT} No Load to Full Load | - | 10 | 100 | - | 10 | 100 | mV |
| Voltage Trim | V_{OUT} Full Load | -20 | 0 | 10 | -20 | - | 10 | % |
| EFFICIENCY | Full Load | 74 | 80 | - | 79 | 83 | - | % |
| LOAD FAULT POWER DISSIPATION | Overload ⁴ | - | 45 | - | - | 45 | - | W |
| | Short Circuit ⁴ | - | 45 | - | - | 45 | - | W |
| CAPACITIVE LOAD ⁴ | | - | - | 2000 | - | - | 2000 | μF |
| SWITCHING FREQUENCY | | 450 | 500 | 550 | 450 | 500 | 550 | kHz |
| SYNC FREQUENCY RANGE | $V_H - V_L = 5\text{V}$ Duty Cycle = 20% - 80% | 450 | 500 | 550 | 450 | 500 | 550 | kHz |
| ISOLATION | 500 V _{DC} | 100 | - | - | 100 | - | - | MΩ |
| MTBF (MIL-HDBK-217F) | GB @ $T_C = 55^{\circ}\text{C}$ | - | 955 | - | - | 955 | - | kHrs |
| DYNAMIC | | | | | | | | |
| Load Step Output Transient | V_{OUT} Half Load to Full Load | - | 200 | 450 | - | 300 | 550 | mV _{PK} |
| Load Step Recovery ² | | - | 200 | 650 | - | 200 | 600 | μSec |
| Line Step Output Transient ⁴ | V_{OUT} $V_{IN} = 18\text{V}$ to 40V | - | 150 | 300 | - | 150 | 300 | mV _{PK} |
| Line Step Recovery ^{2,4} | | - | 50 | 150 | - | 50 | 150 | μSec |
| Turn On Delay | V_{OUT} $V_{IN} = 0\text{V}$ to 28V | - | 20 | 30 | - | 20 | 30 | mSec |
| Turn On Overshoot | | - | 0 | 30 | - | 0 | 50 | mV _{PK} |

Notes: 1. Dependant on output voltage. 2. Time for output voltage to settle within 1% of its nominal value. 3. Derate linearly to 0 at 110°C. 4. Verified by qualification testing. 5. 100% output power available for $V_{IN} = 18\text{V}$ to 50V and only 60% output power available for $V_{IN} = 16\text{V}$ to 18V.

SPECIFICATIONS ($T_{CASE} = -55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$, $V_{IN} = +28\text{V} \pm 5\%$, Full Load, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

| | | | |
|---|-------------|--------------------------------------|---|
| Input Voltage (Continuous) | 50 V_{DC} | Junction Temperature Rise to Case | $+25^{\circ}\text{C}$ |
| Input Voltage (Transient, 1 second) ⁴ | 55 Volts | Storage Temperature | -65°C to $+135^{\circ}\text{C}$ |
| Output Power ^{1,3} | 200 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE} = +100^{\circ}\text{C}$) | 44 Watts | Weight (Maximum) | 115 Grams |

| Parameter | Conditions | DV200-2812S | | | DV200-2815S | | | Units |
|---|--|-------------|------|-------|-------------|------|--------|-------------------|
| | | Min | Typ | Max | Min | Typ | Max | |
| STATIC | | | | | | | | |
| INPUT Voltage ⁵ | Continuous | 16 | 28 | 50 | 16 | 28 | 50 | V |
| | Transient, 1 sec ⁴ | - | - | 55 | - | - | 55 | V |
| Current | Inhibited | - | 6 | 10 | - | 6 | 10 | mA |
| | No Load | - | 20 | 50 | - | 20 | 50 | mA |
| Ripple Current | Full Load, 20Hz to 10MHz | - | - | 150 | - | - | 150 | mA_{p-p} |
| Inhibit Pin Input ⁴ | To Disable Output | 0 | - | 1.5 | 0 | - | 1.5 | V |
| Inhibit Pin Open Circuit Voltage ⁴ | | 8 | 9.5 | 11 | 8 | 9.5 | 11 | V |
| UVLO Turn On | | 13.5 | 15 | 15.8 | 13.5 | 15 | 15.8 | V |
| UVLO Turn Off ⁴ | | 10.0 | 12.0 | 14.0 | 10.0 | 12.0 | 14.0 | V |
| OUTPUT Voltage | V_{OUT} $T_{CASE} = 25^{\circ}\text{C}$ | 11.88 | 12.0 | 12.12 | 14.85 | 15.0 | 15.15 | V |
| | V_{OUT} $T_{CASE} = -55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$ | 11.82 | 12.0 | 12.18 | 14.775 | 15.0 | 15.225 | V |
| Power ³ | $V_{IN} = 18\text{V}$ to 50V | 0 | - | 175 | 0 | - | 200 | W |
| | $V_{IN} = 16\text{V}$ to 18V | 0 | - | 105 | 0 | - | 120 | W |
| Current ³ | I_{OUT} $V_{IN} = 18\text{V}$ to 50V | 0 | - | 14.6 | 0 | - | 13.3 | A |
| | I_{OUT} $V_{IN} = 16\text{V}$ to 18V | 0 | - | 8.76 | 0 | - | 7.98 | A |
| Ripple Voltage | V_{OUT} Full Load, 10kHz to 10MHz | - | 100 | 200 | - | 100 | 200 | mV_{p-p} |
| | V_{OUT} Full Load, 10kHz to 2MHz | - | 5 | 30 | - | 5 | 30 | mV_{p-p} |
| Line Regulation | V_{OUT} $V_{IN} = 18\text{V}$ to 50V | - | 10 | 100 | - | 10 | 100 | mV |
| Load Regulation | V_{OUT} No Load to Full Load | - | 10 | 120 | - | 10 | 120 | mV |
| Voltage Trim | V_{OUT} Full Load | -20 | - | 10 | -20 | - | 10 | % |
| EFFICIENCY | Full Load | 82 | 84 | - | 82 | 86 | - | % |
| LOAD FAULT POWER DISSIPATION | Overload ⁴ | - | 45 | - | - | 45 | - | W |
| | Short Circuit ⁴ | - | 45 | - | - | 45 | - | W |
| CAPACITIVE LOAD ⁴ | | - | - | 1000 | - | - | 1000 | μF |
| SWITCHING FREQUENCY | | 450 | 500 | 550 | 450 | 500 | 550 | kHz |
| SYNC FREQUENCY RANGE | $V_H - V_L = 5\text{V}$ Duty Cycle = 20% - 80% | 450 | 500 | 550 | 450 | 500 | 550 | kHz |
| ISOLATION | $500 V_{DC}$ | 100 | - | - | 100 | - | - | M Ω |
| MTBF (MIL-HDBK-217F) | GB @ $T_C = 55^{\circ}\text{C}$ | - | 955 | - | - | 955 | - | kHrs |
| DYNAMIC | | | | | | | | |
| Load Step Output Transient | V_{OUT} Half Load to Full Load | - | 550 | 1000 | - | 1000 | 1350 | mV_{PK} |
| Load Step Recovery ² | | - | 200 | 400 | - | 200 | 500 | μSec |
| Line Step Output Transient ⁴ | V_{OUT} $V_{IN} = 18\text{V}$ to 40V | - | 1000 | 1200 | - | 1000 | 1200 | mV_{PK} |
| Line Step Recovery ^{2,4} | | - | 50 | 200 | - | 50 | 200 | μSec |
| Turn On Delay | V_{OUT} $V_{IN} = 0\text{V}$ to 28V | - | 20 | 30 | - | 20 | 30 | mSec |
| Turn On Overshoot | | - | - | 50 | - | - | 50 | mV_{PK} |

Notes: 1. Dependant on output voltage. 2. Time for output voltage to settle within 1% of its nominal value. 3. Derate linearly to 0 at 110°C .
4. Verified by qualification testing. 5. 100% output power available for $V_{IN} = 18\text{V}$ to 50V and only 60% output power available for $V_{IN} = 16\text{V}$ to 18V .

BLOCK DIAGRAM

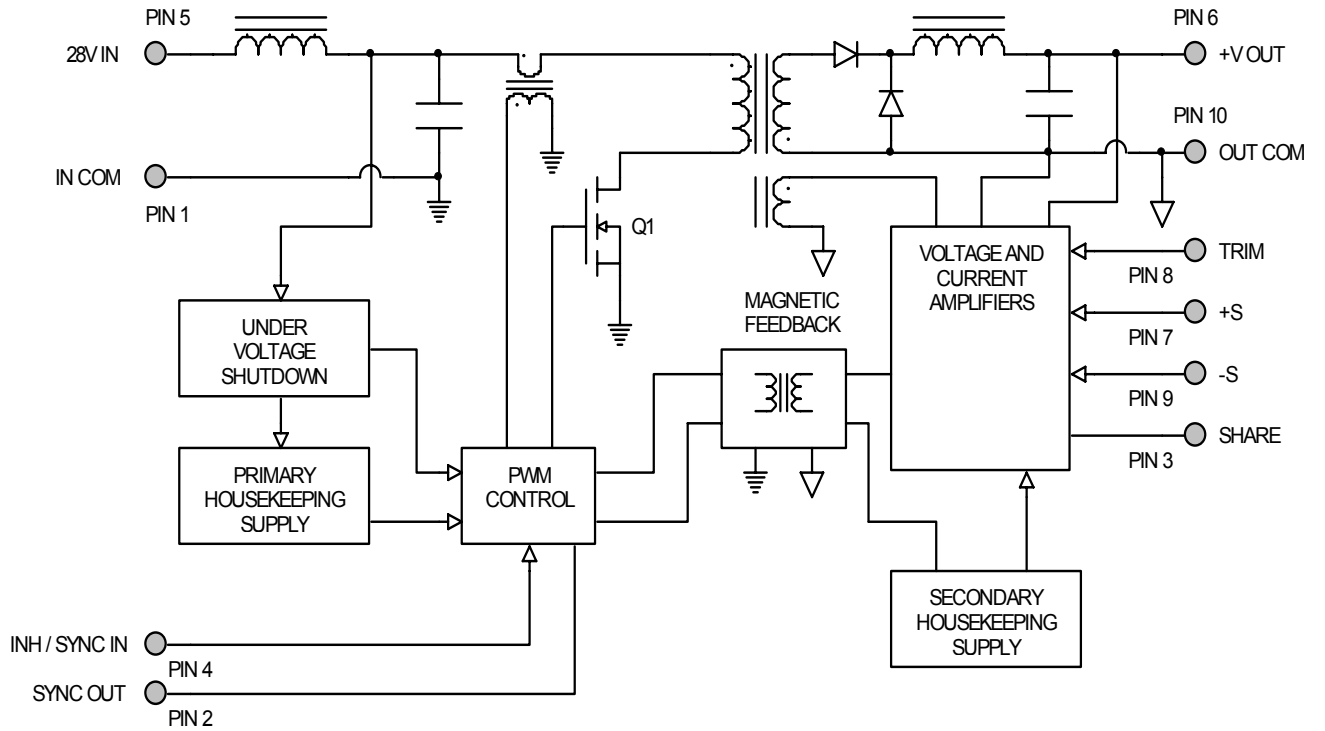


Figure 2

CONNECTION DIAGRAM

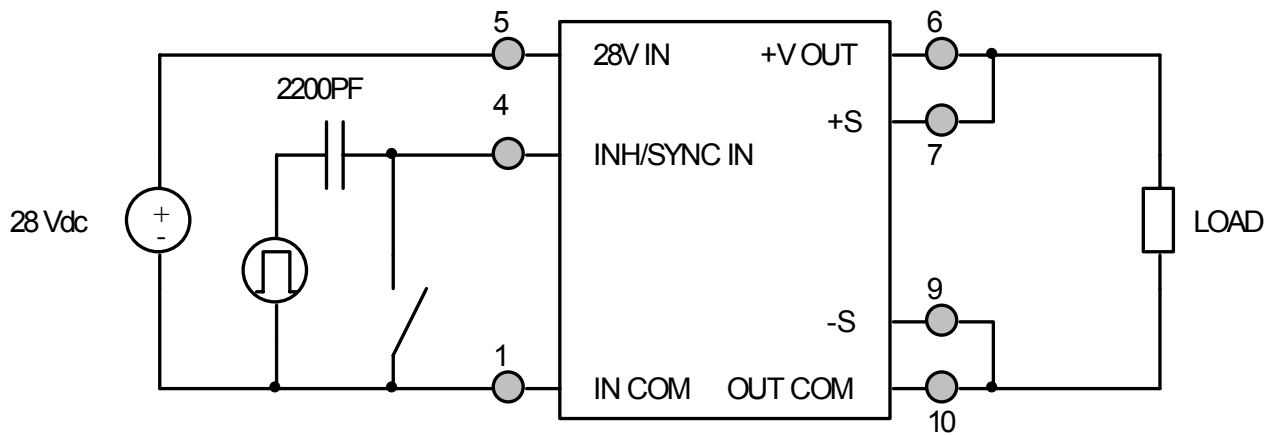


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAMS

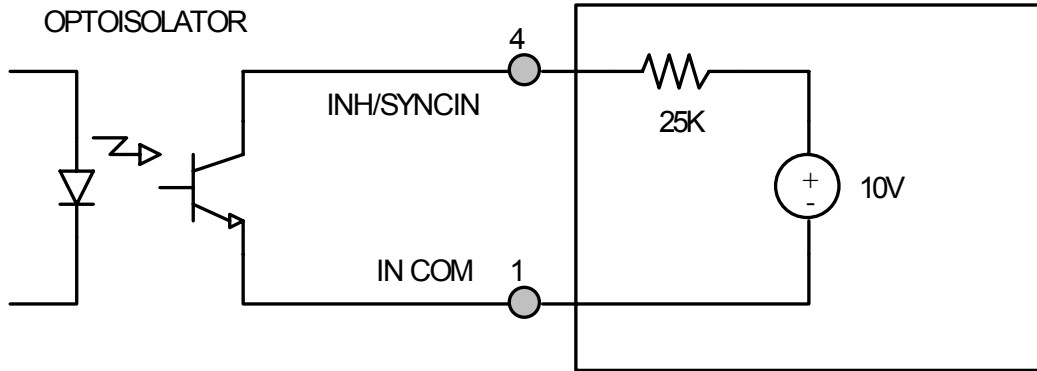


Figure 4 – Isolated Inhibit Drive and Internal Equivalent Circuit

PARALLEL CONNECTION DIAGRAM

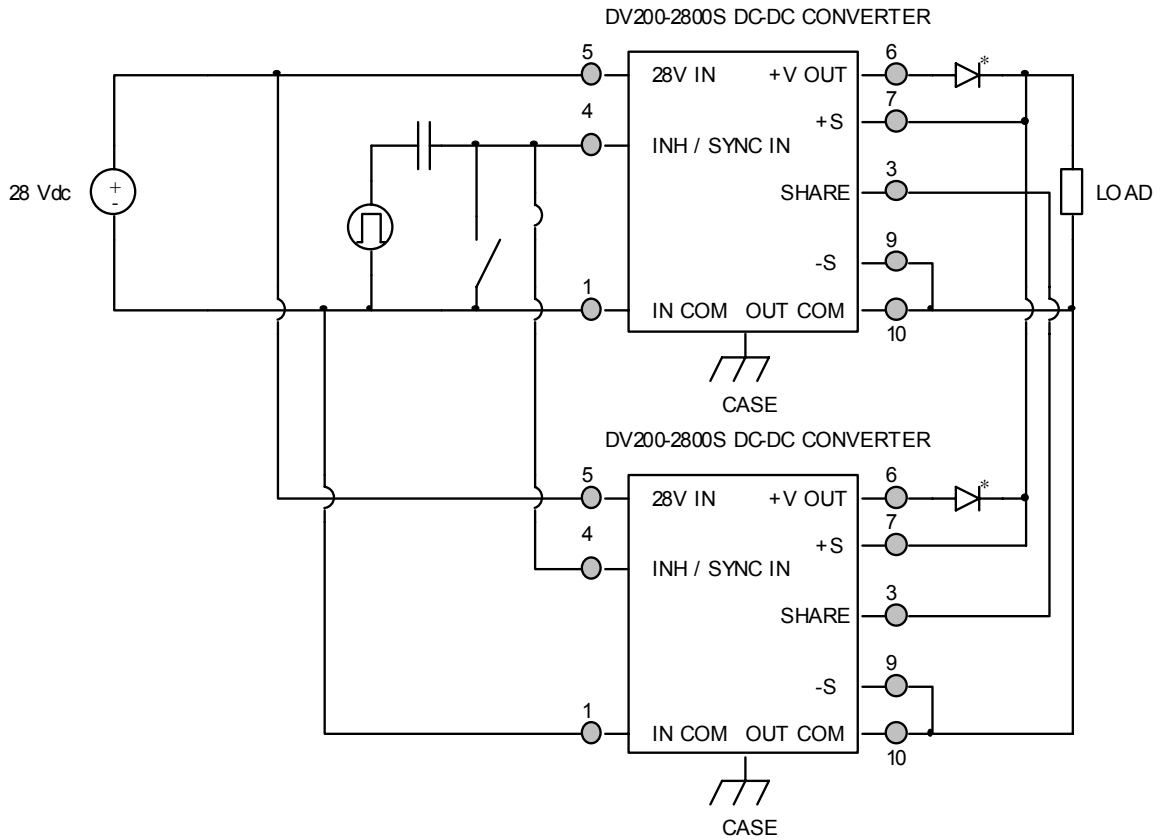
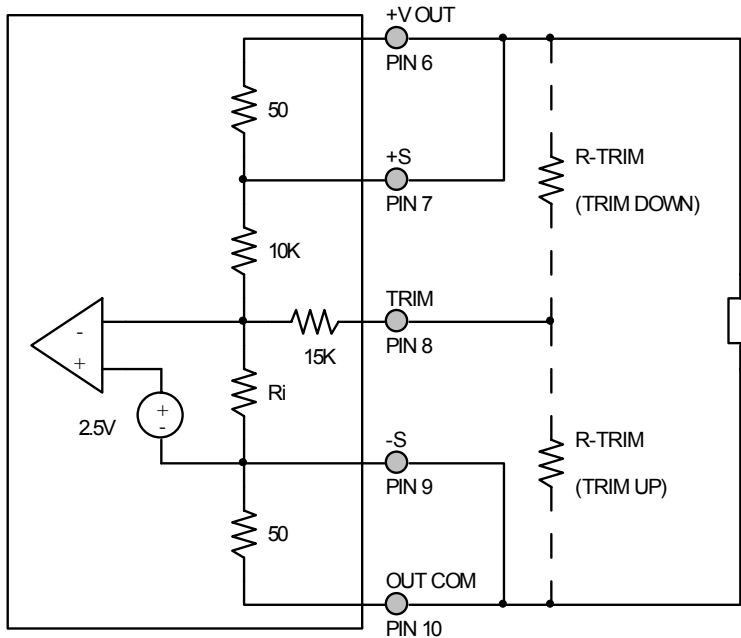


Figure 5 – Parallel Connection with Current Sharing
(*Shown with optional "OR" ing diode)

OUTPUT VOLTAGE TRIM

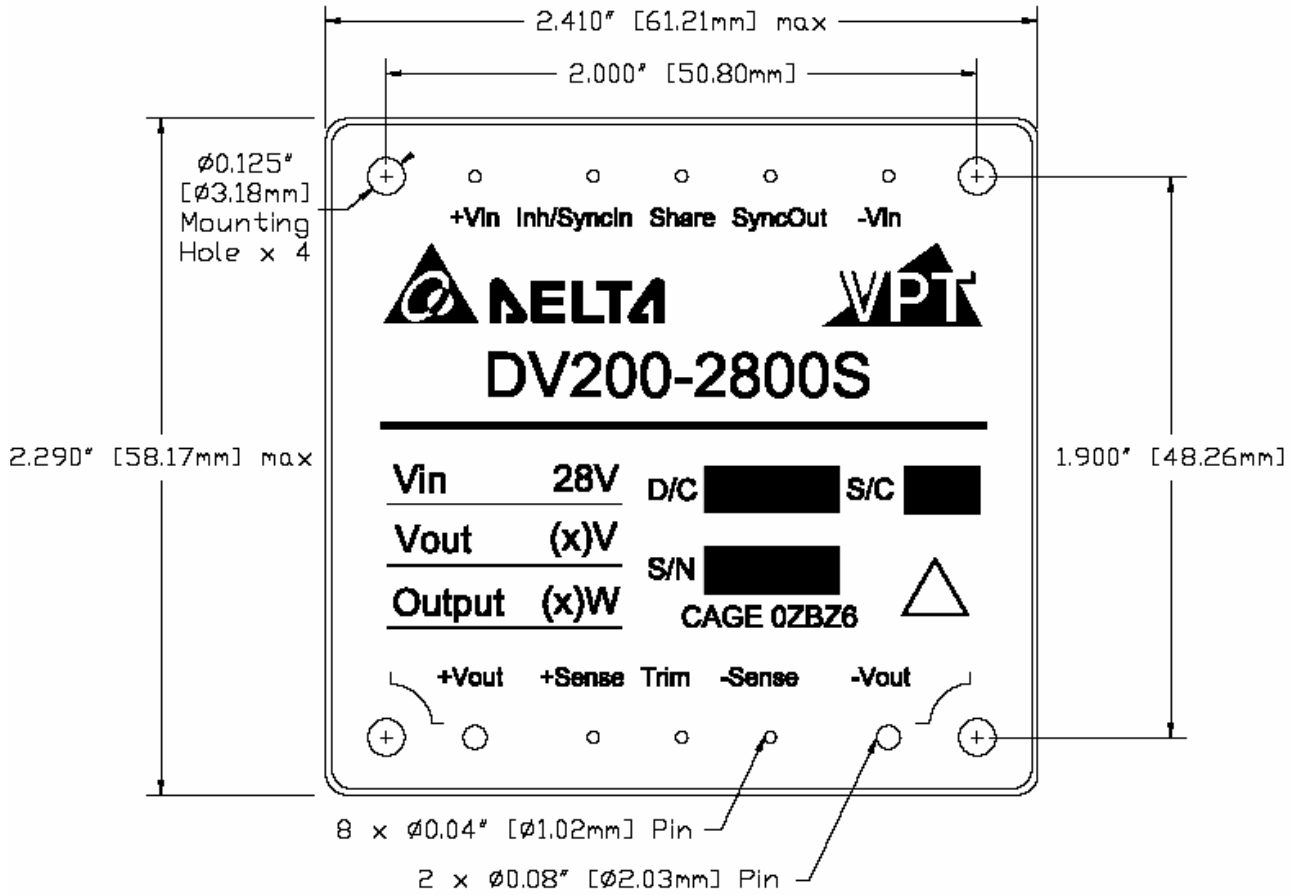


The output voltage can be trimmed down by connecting a resistor between the TRIM pin (PIN 8) and the +V OUT pin (PIN 6), or can be trimmed up by connecting a resistor between the TRIM pin (PIN 8) and the OUT COM pin (PIN 10). The maximum trim range is +10% up and -20% down. The appropriate resistor values versus the output voltage are given in the trim table below.

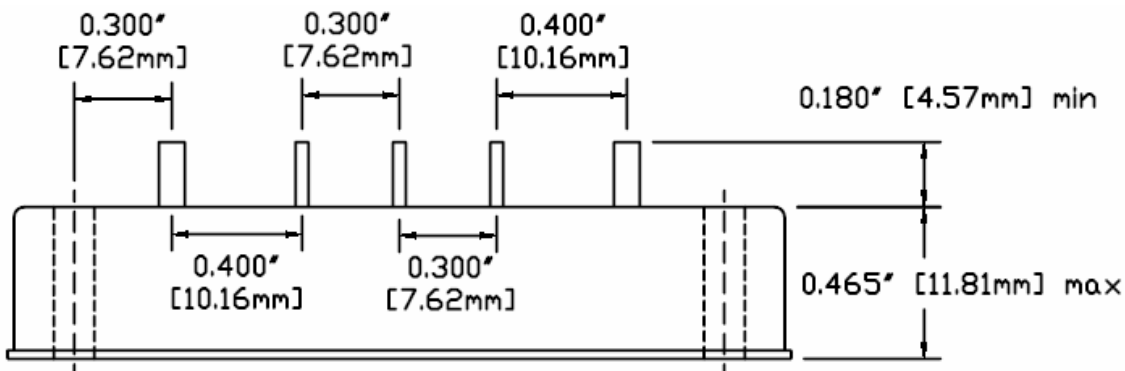
Figure 6 – Output Voltage Trim

| DV200-283R3S | | DV200-2805S | | DV200-2812S | | DV200-2815S | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| +V _{OUT} (V) | R _{TRIM} (Ω) | +V _{OUT} (V) | R _{TRIM} (Ω) | +V _{OUT} (V) | R _{TRIM} (Ω) | +V _{OUT} (V) | R _{TRIM} (Ω) |
| 3.60 | 68.3k | 5.5 | 35k | 13.2 | 5.8k | 16.50 | 1.7k |
| 3.55 | 85k | 5.4 | 47.5k | 13.0 | 10k | 16.25 | 5k |
| 3.50 | 110k | 5.3 | 68.3k | 12.8 | 16.2k | 16.00 | 10k |
| 3.45 | 151.7k | 5.2 | 110k | 12.6 | 26.6k | 15.75 | 18.3k |
| 3.40 | 235k | 5.1 | 235k | 12.4 | 47.3k | 15.50 | 35k |
| 3.35 | 485k | 5.0 | - | 12.2 | 109k | 15.25 | 85k |
| 3.30 | - | 4.9 | 225k | 12.0 | - | 15.00 | - |
| 3.25 | 135k | 4.8 | 100k | 11.8 | 454k | 14.75 | 475k |
| 3.20 | 55k | 4.7 | 58.3k | 11.6 | 213k | 14.50 | 225k |
| 3.15 | 28.3k | 4.6 | 37.5k | 11.4 | 134k | 14.25 | 142k |
| 3.10 | 15k | 4.5 | 25k | 11.2 | 94k | 14.00 | 100k |
| 3.05 | 7k | 4.4 | 16.7k | 11.0 | 70.1k | 13.75 | 75k |
| 3.00 | 1.7k | 4.3 | 10.7k | 10.8 | 54.3k | 13.50 | 58.3k |
| | | 4.2 | 6.3k | 10.6 | 42.9k | 13.25 | 46.4k |
| | | 4.1 | 2.8k | 10.4 | 34.4k | 13.00 | 37.5k |
| | | 4.0 | 0 | 10.2 | 27.8k | 12.75 | 30.6k |
| | | | | 10.0 | 22.5k | 12.50 | 25k |
| | | | | 9.8 | 18.2k | 12.25 | 20.5k |
| | | | | 9.6 | 14.6k | 12.00 | 16.7k |

PACKAGE SPECIFICATIONS



TOP VIEW



| PIN | FUNCTION |
|-----|---------------|
| 1 | IN COM |
| 2 | SYNC OUT |
| 3 | SHARE |
| 4 | INH / SYNC IN |
| 5 | 28V IN |
| 6 | +V OUT |
| 7 | +S |
| 8 | TRIM |
| 9 | -S |
| 10 | OUT COM |

SIDE VIEW

Figure 7 – Package and Pinout
 (Dimensional Limits are $\pm 0.005''$ Unless Otherwise Stated)

PACKAGE PIN DESCRIPTION

| Pin | Function | Description |
|-----|---------------|--|
| 1 | IN COM | Input Common Connection |
| 2 | SYNC OUT | Output Synchronization Signal |
| 3 | SHARE | Current Share |
| 4 | INH / SYNC IN | Logic Low = Disabled Output. Unconnected or open collector TTL or Square-wave Synchronization Signal = Enabled Output. |
| 5 | 28V IN | Positive Input Voltage Connection |
| 6 | +V OUT | Positive Output Voltage Connection |
| 7 | +S | Positive Sense |
| 8 | TRIM | Trim Output Voltage to +10%, -20% of Nominal Value |
| 9 | -S | Return Sense |
| 10 | OUT COM | Output Common Connection |

ENVIRONMENTAL SCREENING

| Screening | Condition | Standard (No Suffix) | Military /ML |
|---------------------|---|----------------------|--------------|
| Pre-Cap Inspection | IPC-A-610 Class II | • | • |
| Temperature Cycling | -55°C, 100°C, 10 Cycles | | • |
| Burn-In | 96 hours at +100°C 12 hours at +100°C | • | • |
| Final Electrical | 100% at -55°C, 25°C, 100°C ¹ 100% at 25°C | • | • |
| Final Inspection | MIL-STD-883, Test Method 2009 | • | • |

Note: 1. 100% R&R testing at -55°C, +25°C, and +100°C with all test data included in product shipment.

ORDERING INFORMATION

| | | | | | | |
|---------------|-----------|-----------|----------|------------|---|------------|
| DV200- | 28 | 05 | S | /ML | - | XXX |
| 1 | 2 | 3 | 4 | 5 | | 6 |

(1)

(2)

(3)

| Product Series | Nominal Input Voltage | | Output Voltage | |
|----------------|-----------------------|----------|---|--|
| DV200- | 28 | 28 Volts | 3R3 05 12 15 | 3.3 Volts 5 Volts 12 Volts 15 Volts |

(4)

(5)

(6)

| Number of Outputs | | Screening Code ¹ | | Additional Screening Code |
|-------------------|--------|-----------------------------|----------------------|---------------------------|
| S | Single | None /ML | Standard Military | Contact Sales |

Notes: 1. VPT Inc. reserves the right to ship higher screened products to meet lower screened orders at our sole discretion unless specifically forbidden by customer contract.

Please contact your sales representative or the VPT Inc. Sales Department for more information concerning additional environmental screening and testing, different input voltage, output voltage, power requirement, source inspection, and/or special element evaluation for space or other higher quality applications.



CONTACT INFORMATION

To request a quotation or place orders please contact your sales representative or the VPT Inc. Sales Department at:

Phone: (425) 353-3010
Fax: (425) 353-4030
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